Letters to the Editor.

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The Cause of Rickets.

THE scientific interest of the work that has been done and is reviewed in the leading article in NATURE of July 29, p. 137, is that it shows that ultra-violet light, acting on the skin, produces by a photo-chemical reaction a definite substance which circulates in the blood. This substance is able to replace vitamin-A in the food; whether wholly or only partially is not yet certain, although it should not be difficult to decide the question. If the former, it appears that light actually causes the formation of the vitamin, as suggested by Prof. Harden, or at all events some compound closely similar to it. Dr. Rollier finds in his sunlight treatment of tuberculosis that cod-liver oil is quite unnecessary; but, of course, his patients get vitamin-A in butter and so on. In rickets, vitamin-A can apparently be reduced to a very small amount if there is plenty of sunlight, but it is uncertain whether the vitamin can completely replace sunlight.

Looking at the evidence as a whole, it seems to me that the six or seven causes enumerated in Dr. Findlay's article may really be reduced to two and perhaps ultimately to one. These two are deficiency of sunlight and of vitamin-A. Taking the remaining suggested causes in the order mentioned, it is obvious that bone cannot be made without its constituents calcium and phosphate, and, as the article points out, this is not a matter of great practical importance, especially if a proper quantity of milk is included in the diet. As to the avoiding of cereals in favour of meat, it seems that the question here is really one of the rate of growth. There is no doubt that the more rapid the growth, the more vitamin-A is needed, probably because it is stored to some extent in the new tissues, especially if these consist of much fat. Prof. Mellanby's experiments showed clearly that the addition of carbohydrate to the diet of his puppies necessitated more vitamin because the growth was so much more rapid than on meat diet alone. It is of interest that Dr. Rollier's experience with tuberculous cases is at variance with Dr. Findlay's with rickets. Rollier finds that much meat is injurious, and that oatmeal is one of the best foods. At the same time, he deprecates over-feeding.

The next cause, rapid growth, has been dealt with above.

I am inclined to think that the factors included in bodily confinement and lack of exercise actually mean lack of sunlight. I understand that at Johns Hopkins Hospital it was found that the two factors mentioned were immaterial if exposure to ultra-violet light was given. It is very doubtful whether massage and electrical treatment have much effect. It is remarkable that the effects ascribed to these are obtained by Rollier in cases which of necessity have to lie quiet, such as tuberculous vertebræ, by the action of sunlight alone. The firmness and "tone," even growth, of the muscles is very obvious.

I doubt whether much advance is likely to be made by obscure references to increase of general metabolism as an explanation of the action of ultra-violet light. The dogmatic statement that animal protein is of especial value rests on no good evidence. Apart from vitamin-A, diet does not seem of great importance, and even this vitamin may be reduced to a very small quantity in presence of adequate sunlight.

Should not "vitamin-B" in the seventh line from the bottom of the first column on p. 138 read "vitamin-A"? And also in the sixth line from the top of the second column?

I would conclude that we can reduce the effective factors in the prevention of rickets to vitamin-A and sunlight. It may be found to sunlight alone.

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I AM much obliged to Sir William Bayliss for pointing out my inexcusable mistake of writing "B" for "A" vitamin. One of the advantages of solving the rickets question may be that we shall be able to use a more definitive and memorable nomenclature. "Anti-rachitic" factor is at present plainly inadmissible; it would be pleasant to call it "Hopkins' stuff," were it not obvious that the identity of the substances which promote growth and have a preventive influence on rickets is still an open question.

On the general question it seems to me that Sir William Bayliss is too ready to accept as a demonstrated fact that ultra-violet light, acting on the skin, produces by a photo-chemical reaction a substance which is equivalent to or identical with the factor in cod-liver oil which influences growth and rickets. It is a very tempting hypothesis because it brings into line a number of apparently discrepant observations. But it neglects a great mass of clinical experience which relates the occurrence of obvious rickets to the total intake of food and to the influence of exercise and massage. This experience may not be capable of the precise formulation one would like, it may not be of any very high order of observational or experimental accuracy, but it has, I think, none the less to be taken into account. It is known too, though here again the data are not beyond criticism, that light increases the rate of general metabolism in experimental animals.

The alternative hypothesis suggested in the article seems to have the advantage of bringing all the more or less certain and uncertain data which are available into line. What is, of course, needed is a whole series of clinical experiments made with the control and precision of the observations carried out by Dr. Harriette Chick and her colleagues in Vienna. Experiments of this kind are laborious and difficult. Meanwhile the practical sanitarian can get to work with sunlight and cod-liver oil and abolish the disease before any one has found out what part of the spectrum is effective.

THE WRITER OF THE ARTICLE.

The Phenomena and Conditions of Sex-change in the Oyster (*O. edulis*) and Crepidula.

IN NATURE of December 15, 1921 (vol. 108, p. 500), I described an experiment from which a sexually mature male oyster was obtained of a maximum age of 23 weeks, from the River Blackwater. In this experiment a fair number of oysters born in 1921 were obtained on specially prepared shells kept isolated *in the sea* with the view of determining the conditions of sex at a known age at later intervals. With the aid of a Government grant from the Royal Society it has been possible to follow up the experiment this year with the following highly interesting results. The young oysters this year were found mostly to be sexually mature or had recently spawned. In one sample of 32 examined from shells on the south shore, River Blackwater, most of the individuals were males, but one large individual (28 × 31 mm.)